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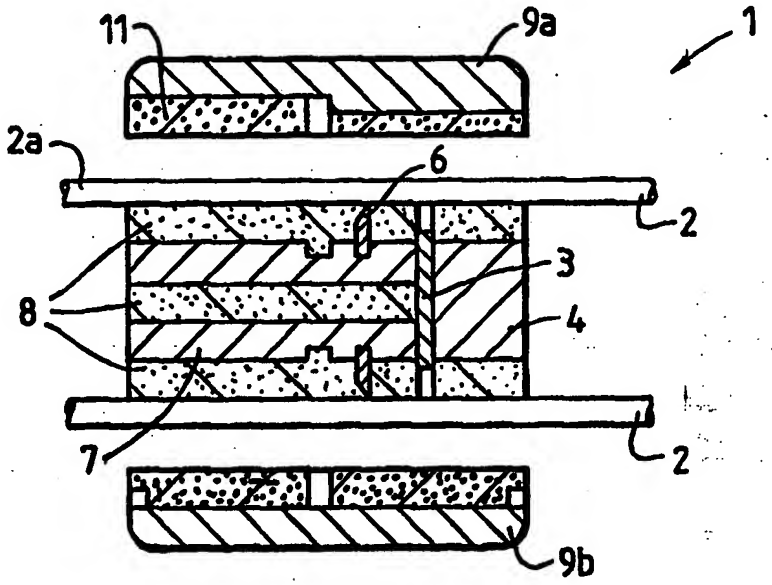
(54) Title: METHOD OF SEALING CABLE ENTRIES USING A SEALING GEL

(57) Abstract

The invention relates to a method of sealing cable entries, especially against moisture and liquids, and to a corresponding cable entry or a cutting/clamping connector (1), with which it is possible for residual cavities also to be closed in a moisture-impermeable manner. This is achieved by means of the fact that the components provided for contacting and closing the entry region are additionally provided, at least in regions, with a sealing grease (11), which, in the contact position, is pressed into cavities that cannot be reached by the gel (8).



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DESCRIPTION

"Method of sealing cable entries using a sealing gel"

The invention relates to a method of sealing cable entries, especially against moisture and liquids, using a sealing gel of the kind specified in the precharacterising clause of claim 1, and to a corresponding cable entry or a cutting/clamping connector having at least one such cable entry.

It is known, for example, from US-4 634 207 to seal electrical contacts against moisture by means of a sealing gel. Small reservoirs of sealing gel are provided in part of a housing so that the contacts are surrounded by the sealing gel when the housing is assembled around the contacts. Another solution is disclosed in DE-C-24 46 221.

A sleeve housing is known from DE-A-41 42 586 which has cable entries in which the sealing region is filled with a sealing gel. DE-A-40 29 082 discloses cable entries with elastic or plastic, compressible seals.

Although the known sealing gel seals do give very good results, it is necessary to keep the sealing gel under a certain bias pressure throughout the life of the sealing region. If that pressure decreases or cannot be applied from the outset because of the peculiarities of the relevant components, owing to the surface tension of the sealing gel, for example as a result of extension by a cable conductor which has been pushed in, any cavity joints or grooves formed may not be reliably filled with sealing gel, with the result that moisture ingress may still occur.

The problem with which the invention is concerned is to provide a solution with which it is possible for residual cavities also to be closed in a moisture-impermeable manner.

Using a method of the kind according to the precharacterising clause of claim 1, that problem is solved according to the invention by means of

the fact that the components provided for contacting and closing the entry region are additionally provided, at least in regions, with a sealing grease which, in the contact position, is pressed into cavities that cannot be reached by the gel.

The procedure according to the invention ensures that even those cavities which cannot be reached by the gel are sealed, since the sealing grease additionally provided can easily be pressed into those spaces.

In the case of a method for sealing cable contact elements in which it may be difficult to apply a sufficiently high fixed force for the sealing gel from the outset, in order to solve the above problem, the invention provides for the housing parts that are movable for the purpose of contacting and closing the housing to be provided, at least in regions, with a sealing grease which, in the contact position, is pressed into the cavities that are not reached by the gel.

In construction, provision is made for the use of a gel having a cone penetration of from 100 to 350 (10^{-1} mm) and an elongation at break of at least 200 %, and a sealing grease. An appropriate gel having the parameters mentioned above is known per se from the reference forming the precharacterising clause of claim 1.

In order to solve the problem mentioned above, the invention also provides a cable entry, for example into cable conduits, housing walls, cable sleeves or the like, which is characterised in that regions filled with sealing grease are associated with regions filled with sealing gel.

In order to solve the problem mentioned above, the invention further provides a cutting/clamping connector for electrically insulated conductors, the housing of which connector is filled, at least in regions, with a sealing gel, while sealing regions that cannot be reached by the sealing gel are filled with a viscous sealing grease.

Although contact elements are known from the specification forming the precharacterising clause of claim 1, none are known with cutting/clamping connectors filled with sealing gel as are becoming

increasingly widespread especially in the connection technology used today for electrically insulated conductors. It is precisely the large number of use situations that makes a very good moisture impermeability of such cutting/clamping connectors especially important. It is here that the invention puts its solution into effect.

In construction, provision is made for housing regions that can be moved for contacting purposes to be provided with a coating of grease at least in regions on their surface facing the interior of the housing.

In order to keep an excess amount of grease available, the grease coating volume is advantageously greater than the residual volume of the housing available to the grease in the contact position, thus reliably ensuring that the grease is also pressed into all cavities. Advantageously, a gel having the features already indicated above is also used here.

The invention is described in detail below by way of example and with reference to the drawings, in which:

Fig. 1 shows a cross-section through a cutting/clamping connector according to the invention before assembly,

Fig. 2 shows a cross-section of the cutting/clamping connector after assembly,

Fig. 3 is a detailed view according to arrow III-III in Fig. 2,

Fig. 4 and 5 are views onto a housing entry or a conduit transition as a cable entry according to the invention, and

Fig. 6 shows a longitudinal section through a corresponding component of a different construction.

The cutting/clamping connector generally designated 1 is used to connect two electrically insulated conductors 2 to each other in an

electrically conductive manner by means of a contact blade 3 arranged in the inner housing part 4 of the cutting/clamping connector 1.

The surplus lengths of the conductors 2, designated 2a in Fig. 1, are cut off using cutting blades 6 and are pulled to the left out of the cutting/clamping connector 1. To effect contacting and activation of the blades 6, the housing lids designated 9a and 9b are pressed onto the middle part of the housing.

Both the through-channels for the conductors 2, designated 10 in Fig. 3, and a central test bore 7 are filled with a sealing gel 8 into which the conductors 2 can be pressed and through which a test probe of a testing element can be pushed until it reaches the contact blade 3.

In the example shown, the movable housing parts 9a and 9b are filled at their inward-facing surface with a sealing grease 11, this sealing grease filling not being shown in the right-hand half of the drawing in Fig. 3.

When a housing according to the invention is closed to contact electrically insulated conductors 2, the conductors 2 are pressed into the gel 8 as shown in Fig. 3. In that process, although the gel may adhere to the periphery of the channel 10 and, in regions, to the conductor 2, because of the relatively high surface tension of the gel a longitudinal channel, designated 12 in the right-hand half of Figure 3, may be produced between the housing parts 4 and 9, which channel is totally sealed according to the invention with grease 11, as can be seen from the left-hand half of Figure 3.

Fig. 4 shows a cable entry, generally designated la, with housing parts 4a and 9a which are movable towards each other and are pressed against each other in the closed position and which are shown as half-shells having dovetail longitudinal guides 13 at the sides, which half shells are held together by a clip element 14.

In the example shown in Fig. 4, one housing part, namely housing part 4a, is filled with a gel 8a. The housing part 9a has an excess filling of

grease 11a which, as has already been described in detail above, is able to penetrate into longitudinal gaps between, for example, the entering cable 2a and the gel 8a.

Figure 5 shows a different example. In this case, both of the housing halves, designated 4b and 9b, are provided with a gel filling 8b, a supply of grease 11b being provided on the inner surface of one of the gel fillings.

Finally, Fig. 6 shows the possible axially serial arrangement of a gel filling 8c and, behind it, a grease filling 11c in a conical reservoir in such a manner that, when the housing halves 4c and 9c are joined together, part of the grease filling 11c is able to penetrate into any gaps, slits, cavities or the like that may still be present.

The described embodiment of the invention may, of course, still be modified in many respects without departing from the underlying concept. In particular, the invention is not limited to the cutting/clamping connector shown here, but other clamping connectors, which dispense with cutting of the cable cores or conductors, may be equipped in a corresponding manner, and so on.

Claims:

1. A method of sealing a cable entry, especially against moisture and liquids, using an entry region that is filled at least in regions with a sealing gel, characterised in that the component parts provided for contacting and closing the entry region are additionally provided, at least in regions, with a sealing grease which, in the contact position, is pressed into cavities that cannot be reached by the gel.

2. A method according to claim 1, especially for sealing cable contact elements, housed in a housing, against moisture and liquids, wherein housing cavities are filled with a sealing gel, characterised in that the housing parts (9) that are movable for the purpose of contacting and closing the housing are provided at least in regions with a sealing grease (11) which, in the contact position, is pressed into the cavities that are not reached by the gel (8).

3. A method according to claim 1 or 2, characterised by the gel having a cone penetration of from 100 to 350 (10^{-1}mm) and an elongation at break of at least 200 %.

4. A cable entry, especially for introducing cables and electrically insulated conductors into other components, such as cable conduits, housing walls, cable sleeves or the like, in a moisture- and liquid-impermeable manner, having entry regions that are filled at least in regions with a sealing gel, characterised in that regions filled with sealing grease are associated with the regions filled with sealing gel.

5. A cable entry according to claim 4, comprising a cutting/clamping connector for electrically insulated conductors, characterised by a housing (4, 9) that is filled at least in regions with a sealing gel (8), wherein sealing regions that are not

reached by the sealing gel are filled with a viscous sealing grease (11).

6. A cutting/clamping connector according to claim 5, characterised in that regions (9) of the housing that can be moved for contacting purposes are provided with a coating of grease (11) at least in regions on their surface facing the interior (4) of the housing.

7. A cutting/clamping connector according to claim 5 or 6, characterised in that, in order to keep an excess amount of grease available, the grease coating (11) volume is greater than the residual volume of the housing available to the grease in the contact position.

8. A cable entry according to any preceding claim, characterised by the gel having a cone penetration of from 100 to 350 (10^{-1}mm) and an elongation at break of at least 200 %.

Fig.1.

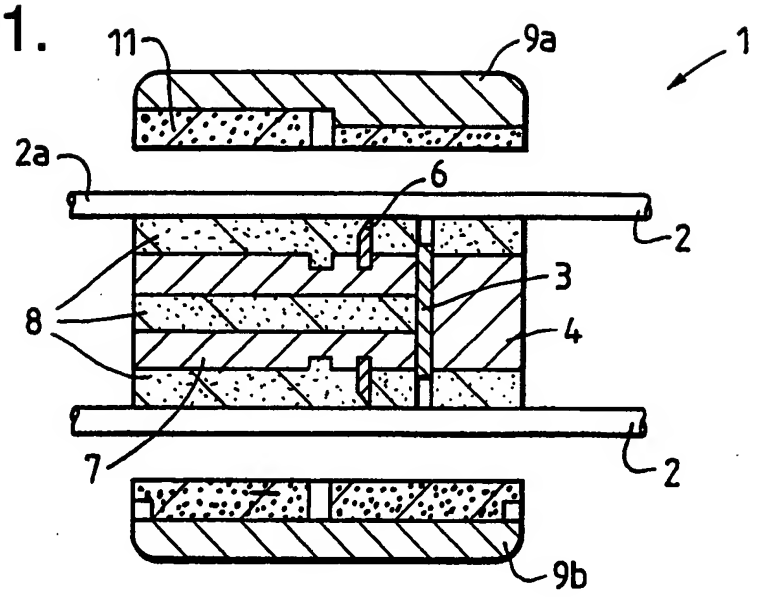


Fig.2.

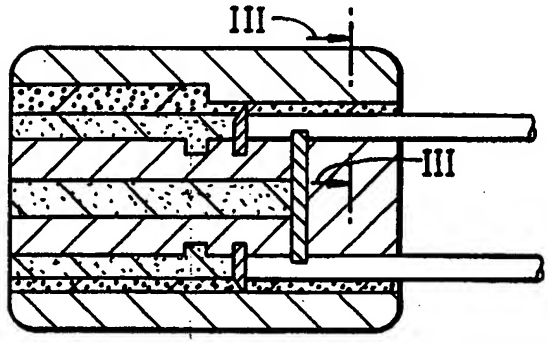


Fig.3.

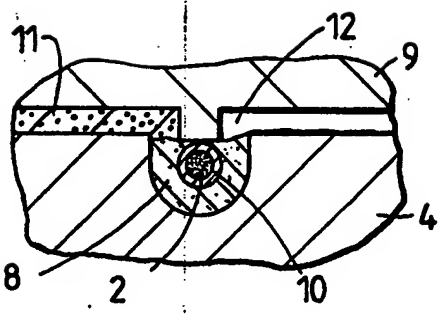


Fig.4.

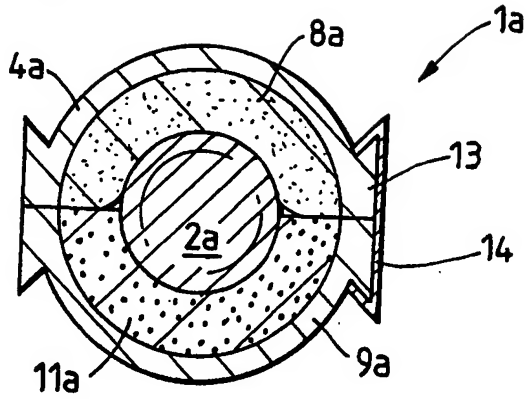


Fig.5.

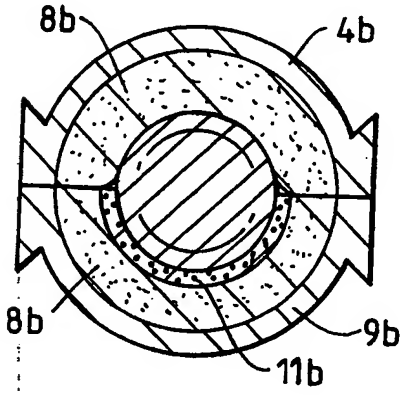
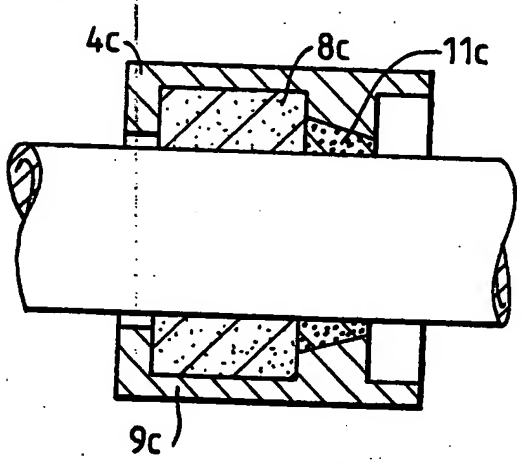


Fig.6.



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IPC 6 H02G15/013 H01R4/24

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	EP,A,0 108 518 (RAYCHEM) 16 May 1984 cited in the application	1,2
A	see abstract; claims 1,11; figures 1-3,7,8 ---	3,8
A	US,A,3 923 362 (R.B. DUNN ET AL.) 2 December 1975 see column 2, line 46 - line 49; claim 1; figures 2,3 ---	1,2,5

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